Direction des Sciences de la Matière
IRFU
Service d'Astrophysique

Soutenance de thèse du Service d'Astrophysique

COSMOLOGY WITH WEAK-LENSING PEAK COUNTS

CHIEH-AN LIN

SAp

Mercredi 28 Septembre – 14h00 – Salle Galilée

Weak gravitational lensing (WL) probes massive structures in the Universe on large scales, providing the information about the late-time evolution of the dark matter. One way to extract the non-Gaussian part of this information is WL peak counts, which have been shown as a promising tool to constrain cosmology.

We propose a new model to predict WL peak counts. The model generates fast simulations based on halo sampling, and selects peaks from the derived lensing maps. This approach has three main advantages. First, the model is very fast: only several seconds are required for performing a realization. Second, including realistic conditions is straightforward. Third, the model provides the full PDF information because of its stochasticity.

We constrain cosmological parameters by combining our model with approximate Bayesian computation (ABC). ABC is a parameter inference method when the likelihood estimation is intractable. It is an accept-reject sampler, and probes a posterior considered close to the true one. Without the need to evaluate the covariance matrix for the likelihood, ABC can considerably reduce the computation cost.

In my talk, I will first explain why modelling WL peak counts is challenging but worth studying. Then, I will introduce our model and validate it by comparing to N -body simulations. After explaining the principle of ABC, I will show the agreement of the ABC constraints with the ones from the likelihood. I will also examine different filtering techniques for WL and study their impacts on constraints. Finally, an outlook will be drawn on parameter constraints using our model applied on the CFHTLenS, KiDS DR1/2, and DES SV data sets.